

# PATENT SPECIFICATION

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818,603

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**International Classification:**—B23p. F25h.

## COMPLETE SPECIFICATION

### Heat Exchangers

We, SERCK RADIATORS LIMITED, of Warwick Road, Great, in the City of Birmingham 11, a British Company, do hereby declare the invention for which we pray that a Patent 5 may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to heat exchangers of the kind consisting of an assembly of thin metal sheets arranged parallel with each other and forming the walls of fluid conducting channels, and secondary heat conducting surfaces formed by corrugated metal sheets or strips located between and attached at their 10 ridges to the walls.

When it is required to manufacture such heat exchangers from aluminium or copper, and to unite the parts by cold or hot pressure or electrical resistance welding a difficulty is 15 encountered in that whereas the corrugated sheets (hereinafter referred to as the gills) can readily be secured to one of the associated walls, it is impracticable to attach them also to the other associated wall, as the welding 20 involves the use of tools by which strong pressure can be applied simultaneously to both of the parts to be united.

The object of the present invention is to provide an efficient heat exchanger construction 25 of the kind aforesaid which enables pressure welding to be employed in a satisfactory manner.

A heat exchanger of the kind aforesaid, and in accordance with the invention, consists of a construction in which gill parts are attached by pressure welding at different positions to both sides of each wall, so that when the walls 30 are assembled the gills between each adjacent pair of wall surfaces occupy the whole of the space between these surfaces.

In the accompanying drawings:

Figure 1 is a perspective view of one of a pair of associated sheetmetal walls having on one of its faces an arrangement of fin parts 35 in accordance with the invention, and Figure 2 is a similar view to Figure 1 showing one

face of the other wall and the complementary fin parts.

Figure 3 is a perspective view illustrating a portion of a stack of the plates shown in 50 Figures 1 and 2.

Figures 4 and 5 are perspective views of a pair of complementary finned plates adapted to be secured together at one pair of longitudinal edges to form a flat tube, and Figure 6 is a fragmentary end view of a portion of a tube assembly constructed from the components shown in Figures 4 and 5.

In the typical example shown in Figures 1—3, each wall consists of a thin aluminium sheet of square shape. At one side the wall *a* is marked out to form nine square areas of equal size, and to each of five of these areas is secured by cold pressure welding the ridges at one side of a transversely corrugated square gill part *b*, four of the latter occupying the corner area of the wall and the fifth occupying the central area.

The adjacent face of the next wall *a* has likewise attached to it four similar and similarly corrugated gill parts *b*, arranged to occupy the gaps between the gill parts *b*, on the wall *a*, so that when these two walls are brought together the whole of the space between them is occupied by the two sets of gill parts *b*.

Reverting to the wall *a*, this has also attached to its other side by pressure welding an arrangement of fin parts *b* similar to those on the wall *a*. Likewise the other side of the wall *a* has attached to it fin parts *b* similar to those on the wall *a*.

The complete exchanger is built up from the desired number of walls having welded to them groups of gill parts as above described, so that all the spaces between the walls are occupied by complementary sets of gill parts.

It will be understood that the spaces occupied by the gill parts alternately form channels for the flow therethrough of the streams of fluids between which heat exchange is required. In some constructions such as that

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shown in Figure 3, these streams are required to flow at right angles to each other, and to meet this requirement the corrugations in the gill parts at one side of each wall plate are disposed at right angles to those at the opposite side. Further at each opposite pair of edges of each wall sheet are formed flanges  $c$ ,  $c_1$  which form the boundaries of the different fluid channels.

10 In the application of the invention as shown in Figures 4—6, to the construction which consists of a plurality of flat-sided tubes arranged parallel with each other, each tube consists of a pair of aluminium strips  $a$ ,  $a_1$ , of appropriate length and width. At the longitudinal edges of the strip  $a$  are formed flanges  $c$  and at the corresponding edges of the strip  $a_1$  are formed flanges  $c_1$ . Before the strips are interconnected there is pressure-welded to one half of the inner face of the strip  $a$ , a longitudinally corrugated fin part  $b$ , and to the inner face of the other strip  $a_1$  is similarly welded a complementary gill part  $b_1$ , which when the two strips are placed together lies alongside of the gill part  $b$ . To the other side of the strip  $a$  is secured a gill part  $b_2$ , which in the example illustrated has its corrugations at right angles to those of the part  $b$ . Likewise a complementary gill part  $b_3$  is secured to the outer side of the strip  $a_1$ . When the two strips are placed together they are interconnected by folding the contiguous

flanges  $c$ ,  $c_1$  as shown in Figure 6.

Instead of aluminium, the component parts of the apparatus may be constructed from copper which metal can also be cold pressure welded, or from a combination of aluminium and copper parts. Alternatively when the parts are made from copper, steel, or other metals and it is desired to weld them together by electrical resistance welding, this is effected by the action of pressure between appropriate electrodes through which the electric current passes.

The invention is not, however, restricted to the typical examples above described, as it may be applied in like manner to other forms of heat exchangers constructed from metal sheets or strips with gills between all of, or in the alternate spaces between them.

#### WHAT WE CLAIM IS:—

1. A heat exchanger of the kind specified, consisting of a construction in which gill parts are attached by pressure or electrical resistance welding at different positions to both sides of each wall, so that when the walls are assembled the gills between each adjacent pair of wall surfaces occupy the whole of the space between these surfaces.

2. A heat exchanger of the kind specified constructed substantially as described and as exemplified by Figures 1—3, or Figures 4—6 of the accompanying drawings.

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#### PROVISIONAL SPECIFICATION

#### Heat Exchangers

We, SERCK RADIATORS LIMITED, of Warwick Road, Greet, in the City of Birmingham, 11, a British Company, do hereby declare this invention to be described in the following statement:—

This invention relates to heat exchangers of the kind consisting of an assembly of thin metal sheets arranged parallel with each other and forming the walls of fluid conducting channels, and secondary heat conducting surfaces formed by their corrugated metal sheets or strips located between and attached at their ridges to the walls.

When it is required to manufacture such heat exchangers from aluminium or copper, and to unite the parts by cold or hot pressure welding a difficulty is encountered in that whereas the corrugated sheets (hereafter referred to as the gills) can readily be secured to one of the associated walls, it is impracticable to attach them also to the other associated wall, as pressure welding involves the use of tools by which strong pressure can be applied simultaneously to both of the parts to be united.

The object of the present invention is to provide an efficient heat exchanger construction of the kind aforesaid which enables pressure welding to be employed in a satisfactory manner.

A heat exchanger of the kind aforesaid, and in accordance with the invention, consists of a construction in which gill parts are attached by pressure welding in different positions to both sides of each wall, so that when the walls are assembled the gills between each adjacent pair of wall surfaces occupy the whole of the space between these surfaces.

In one typical example, each wall consists of a thin aluminium sheet of square shape. At one side the wall is marked out to form nine square areas of equal size, and to each of five of these areas is secured by cold pressure welding the ridges at one side of a transversely corrugated square gill part, four of the latter occupying the corner area of the wall and the fifth occupying the central area.

The adjacent face of the next wall has likewise attached to it four similar and similarly corrugated gill parts, arranged to occupy the gaps between the gill parts on the first described wall, so that when these two walls are brought together the whole of the space between them is occupied by the two sets of gill parts.

Reverting to the first mentioned wall, this has also attached to its outer surface by pressure welding an arrangement of gill parts similar to those on the second mentioned wall,

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and the next wall sheet to be placed adjacent to the said outer side of the first wall has welded to it an arrangement of gill parts similar to the first described set. The complete exchanger is built up from the desired number of walls having welded to it groups of gill parts as above described, so that all the spaces between the walls are occupied by complementary sets of gill parts.

5 It will be understood that the spaces occupied by the gill parts alternately form channels for the flow therethrough of the streams of fluids between which heat exchange is required. In some constructions these streams are required to flow at right angles to each other, and to meet this requirement the corrugations in the gill parts at one side of each wall plate are disposed at right angles to those at the opposite side. Further, at each opposite 10 pair of edges of each wall sheet are formed flanges which form the boundaries of the different fluid channels.

In the application of the invention to a construction which consists of a plurality of flat-sided tubes arranged parallel with each other each tube consists of a pair of aluminium strips of appropriate width and length and having its longitudinal edges adapted to be interlocked to form the required tube. Before the strips 15

are interconnected there is pressure welded to one half of the inner face of one of the strips a longitudinally corrugated gill part, and to the inner face of the other strip is similarly welded a complementary gill part which when the two strips are brought together lies alongside the first gill part. To the outer side of each tube strip is secured another gill part which is complementary to the gill part or parts on the outer side of the next tube. The gill parts between the tubes may be corrugated either longitudinally or transversely.

Instead of aluminium, the component parts of the apparatus may be constructed from copper which metal can also be cold pressure welded, or from a combination of aluminium and copper parts. Alternatively when the parts are made from copper, steel or other metals and it is desired to weld them together by electric welding, this is effected by the action of both heat and pressure between appropriate electrodes.

20 The invention is not, however, restricted to the typical examples above described, as it may be applied in like manner to other forms of heat exchangers constructed from metal sheets or strips, with gills between all of, or the alternate spaces between them.

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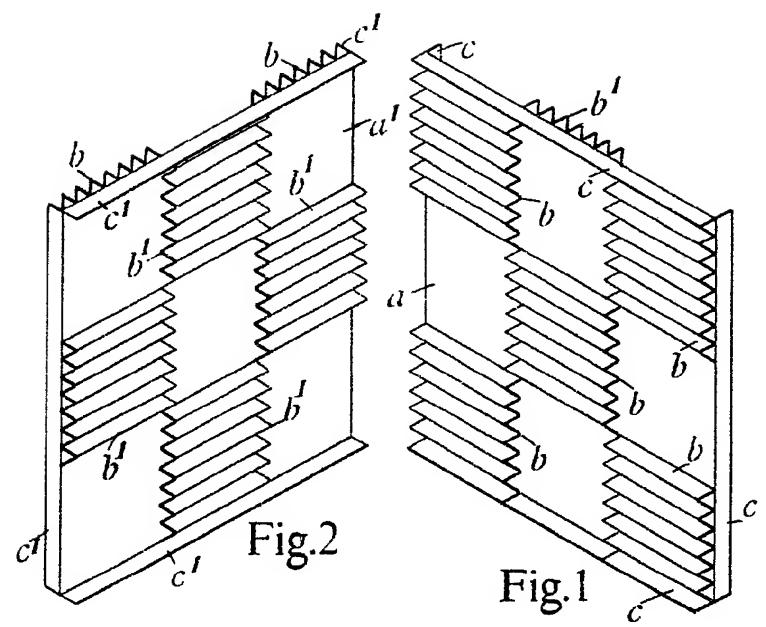


Fig.2

Fig.1

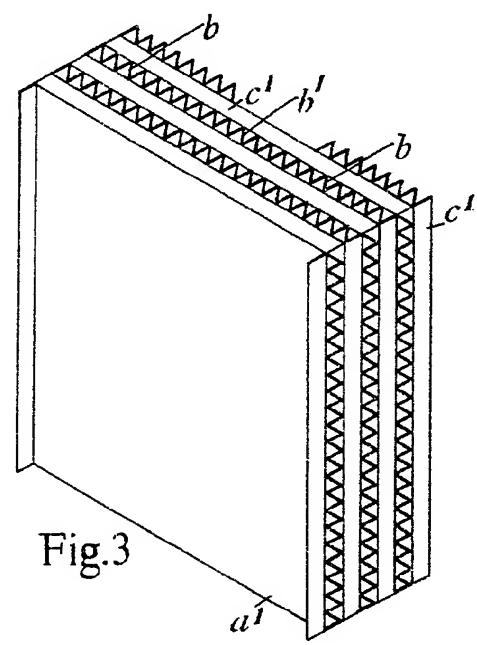


Fig.3

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2 SHEETS

COMPLETE SPECIFICATION

*This drawing is a reproduction of  
the Original on a reduced scale.  
SHEETS 1 & 2*

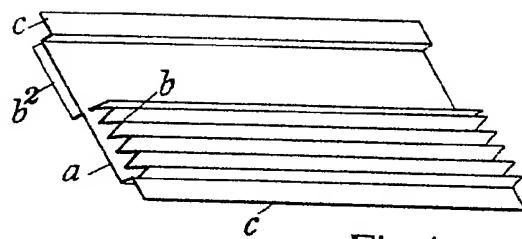


Fig.4

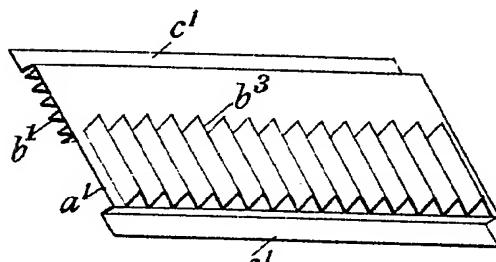


Fig.5

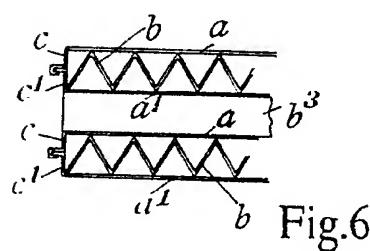


Fig.6

818,603 COMPLETE SPECIFICATION  
2 SHEETS This drawing is a reproduction of  
the Original on a reduced scale.  
SHEETS 1 & 2

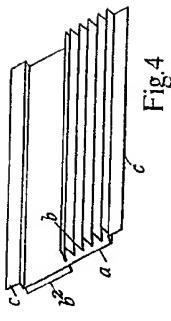


Fig.4

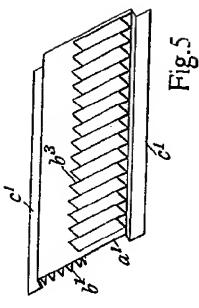


Fig.5

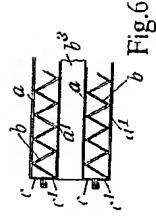


Fig.6

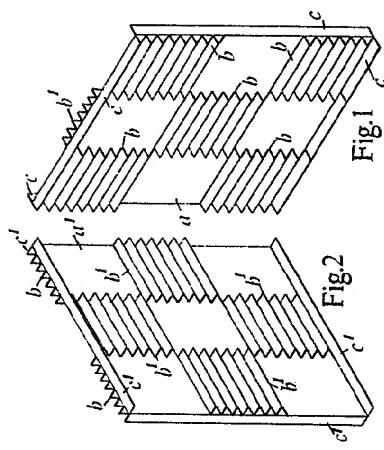


Fig.1

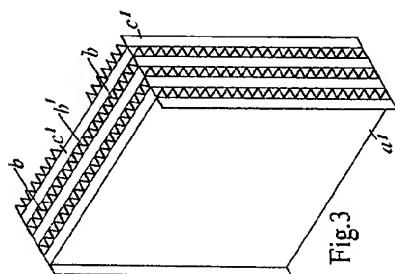


Fig.3

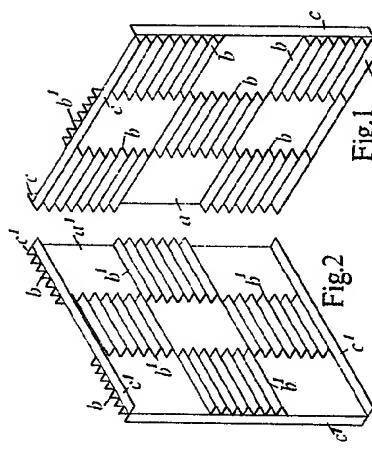


Fig.2